

## 9.0 SUMMARY/CONCLUSION

This study focused on data collected from the Eastside Basin between January 2003 and April 2004. The Eastside Basin consisted of the Stanislaus, Tuolumne, and Merced River Watersheds and the Farmington and Valley Floor Drainage Areas. Objectives of this study were to:

- Determine spatial and temporal trends
  - Spatial trends including moving downstream within individual sub-watersheds as well as comparisons between sub-watersheds of similar hydrologies and between all sub-basin discharges to the San Joaquin River
  - Temporal trends including seasonal variations
- Evaluate stakeholder identified concerns
  - Potential impact of residential construction in a rural community
  - Potential impact of an agriculturally dominated subwatershed
- Conduct a preliminary evaluation of beneficial use protection

In general, the subwatersheds within the Eastside Basin represent areas of diverse geography ranging in elevation from 22 to 13,114-ft, variable land uses (undisturbed, timber, grazing, urban, irrigated agriculture), and highly managed hydrology (from reservoir releases in the Stanislaus, Tuolumne, and Merced Watershed, to the agricultural/urban dominated management of the Farmington and Valley Floor Drainage Areas.).

Sub-watersheds were further divided to identify spatial and temporal trends within each of the sub-watersheds, and separated into two major hydrologies: river basins (Stanislaus, Tuolumne, and Merced Watersheds) and lower sub-basins (Farmington and Valley Floor Drainage areas).

### Summary Spatial and Temporal Trends

Within the river basins, lower watershed concentrations of specific conductance, turbidity, TOC, TSS, and *E. coli* generally increased moving downstream. Tributary sites in both the upper watershed and lower watershed generally had higher temperature, median turbidity, TOC, and TSS than the main stem river sites. Seasonal trends included increased temperature in the summer months, with an inverse trend in DO concentrations. Dips in SC corresponded to reservoir releases. Spikes in turbidity, TSS, TOC, and *E. coli* often occurred after rains. Spikes in turbidity also occurred in Dry Creek during the irrigation season.

Within the lower sub-basins, the Valley Floor area showed greater diversity in DO, SC, and pH concentrations than in the Farmington Area. Additionally, TOC was higher in agriculturally dominated areas (Littlejohns at Austin Road) than in combined urban/agriculturally influenced areas (Lone Tree and French Camp). Total coliforms were generally above the reporting limit (2420 MPN/100ml) at most sites. Median temperatures did not vary greatly between locations, but did fluctuate consistently between all sites by season. Similar to the River Basins, turbidity, TOC, TSS, and *E. coli* at the lower sub-basin sites increased after rainfall events and, in the case of turbidity and *E. coli*, after increased agricultural flows.

Cross sections from the two major hydrology groups were then evaluated. In the river basins, upper watersheds, discharges from impoundments and lower watershed integrators were compared, while in the lower elevation sub-basins, background waters, agriculturally dominated discharges, drains and laterals were compared.

In the river basin upper watersheds, temperature, SC and *E. coli* concentrations were highly variable, outliers for pH were skewed to lower (acidic) concentrations, and turbidity outliers were high, with outliers in the Tuolumne watershed being the highest. Concentrations of TOC were similar to concentrations in the lower watershed, while median total coliform concentrations were generally lower than those in the lower watershed. Concentrations at the reservoir releases were most stable for temperature and DO. In the lower watersheds, temperature and turbidity outliers increased moving north to south, while DO decreased moving north to south, and TSS and total coliform concentrations were the highest in the

Tuolumne Watershed. Lower watershed concentrations of *E. coli* were consistently elevated above the reservoir releases, but were not as variable as concentrations in the upper watersheds.

In the lower elevation water bodies discharging to the SJR and Stanislaus Rivers, the Valley Floor drains were overall higher in all constituents measured except temperature, pH, and DO. The laterals generally had the highest concentrations of those parameters, matched by Farmington for DO. Median temperatures varied by no more than 4-C, with laterals being slightly higher than the drains and Farmington discharge.

Discharges from each river basin, Farmington and Valley Floor drains and laterals were compared as discharges to the San Joaquin River. In summary, temperature values and ranges were somewhat consistent between the six sub-groups. Concentrations and ranges for SC, turbidity, TOC, and *E. coli* were lowest at the three river sites. Concentrations were lowest and least variable in the Stanislaus Watershed. For turbidity and *E. coli*, the Valley Floor laterals were similar to the watershed sites, and for specific conductance, the Farmington site was similar to the watershed sites. The Valley Floor Drains consistently had higher reported concentrations and were more variable for SC, turbidity, TOC, and *E. coli*.

#### Findings Addressing Stakeholder Identified Concerns

Sites were selected along Woods Creek upstream and downstream of a new single family home subdivision to evaluate potential impact of residential construction in a rural community. Concentrations significantly increased downstream of the development for SC, turbidity, boron, calcium, chloride, sulfate, copper, cadmium, and zinc, while concentrations for turbidity, TSS, TOC, total coliform, and magnesium significantly decreased. Concentrations of *E. coli* generally increased significantly, but did occasionally decreased significantly as well. Seasonally, DO generally decreased downstream from March through August, but then increased the rest of the year. Spikes in SC occurred after the first significant rainfall after dry periods, and downstream increases in turbidity were most common during the drier period from May through August.

The potential water quality impact of an agriculturally dominated subwatershed that is tributary to the Tuolumne River was also examined. Most constituents were not significantly changed downstream of the Dry Creek inflow to the Tuolumne River. However, Dry Creek appeared to cause a significant increase in about half the turbidity and *E. coli* concentrations of the Tuolumne River downstream of its confluence. Dry Creek had significantly higher concentrations of SC, turbidity, TSS, TOC, total coliform, *E. coli*, chloride, copper, and zinc than the sites upstream of the confluence, and significantly higher SC, turbidity, TSS, TOC, total coliform, *E. coli*, calcium, magnesium, chloride, hardness, copper and zinc than the sites downstream of the confluence. Overall concentrations increased downstream between the two Tuolumne River sites for TSS, TOC, sulfate, calcium, magnesium, zinc, copper and chloride. Dry Creek concentrations were lower than both Tuolumne River sites for temperature and DO. Chloride was higher in the upstream Tuolumne River site than in Dry Creek.

#### Summary Potential Beneficial Use Concerns

When constituents analyzed were evaluated against water quality objectives (Basin Plan, 2006), targets (Bay Delta Authority), and guidelines (USEPA Contact Recreation), the water quality results indicate that, in general, there is limited indication of beneficial uses impairment for municipal supply, aquatic life, irrigation supply, or recreation within the basin.

In general, water quality met most goals, targets, and objectives. However, some areas of concern have been identified and displayed in detail in Appendix C5 and are summarized in Table 22 (Section 8.3) and below:

Drinking Water/Municipal Supply (Specific Conductance (salt), Minerals, Total Organic Carbon (TOC), Trace Elements, Bacteria): Overall, water quality in the Eastside Basin generally met municipal and domestic supply objectives of goals. Sporadically, there were elevated constituent levels, dependant on

the site and season. Trace elements were generally within water quality goals and objectives, with specific sites having high concentrations of certain elements (elevated cadmium at Woods Creek at Mill Villa Drive and elevated arsenic at Littlejohn's Creek at Sonora Road). The high percent of elevated TOC concentrations (43% of samples collected) makes TOC the highest potential drinking water concern in the Eastside Basin, especially in the drainage areas and lower watershed tributaries. *E. coli* presence in most samples analyzed indicates possible presence of pathogens and a requirement of treatment prior to use for municipal supply, as required by the US EPA Surface Water Treatment Rule, which requires public water systems that use surface water or groundwater under the direct influence of surface water and that serve at least 10,000 people to disinfect water that will be used for municipal purposes.

Aquatic Life (pH, Temperature, Dissolved Oxygen, Turbidity, Water Column Toxicity, and Trace Elements): In general, water quality in the Eastside Basin was within aquatic life objectives, with occasional values outside the limits. Most areas of concern occurred in the Farmington and Valley Floor Drainage areas, especially for pH, dissolved oxygen and trace elements. Unlike drinking water where cadmium and arsenic were the only trace elements with elevated concentrations, zinc and copper were the only trace elements that had elevated concentrations when evaluated for aquatic life. All sites had at least one sample above the temperature target, except the three sites closest to the reservoir releases and sites within the Stanislaus Watershed. Dissolved oxygen concentration at MID Main Drain was below the minimum objective throughout the study period.

Irrigation (Salt represented by SC): The Water Quality Goal for Agriculture has a limit of 700 umhos/cm. Although all sites in the Farmington Drainage Area and the watershed sites met this goal, 38 samples from the Valley Floor Drainage area, from both drains and TID Laterals 6/7 and Lateral 7, were elevated above the goal. These 38 samples represented 6% of the total 600 samples collected during this study and 49% of the total SC samples collected in the Valley Floor Drainage Area.

Recreation (Bacteria): Samples analyzed for *E. coli* were evaluated as a subset of fecal coliform against the Basin Plan Water Quality Objective (<400MPN/100ml, fecal coliform) and USEPA *E. coli* Guidelines for various levels of contact recreation for the entire study period. The same percentage of samples (18%) that were above the Basin Plan objective for contact recreation when looking at the entire study period also were above when looking at just the data from the typical swim period (May through October). All sub basins had some elevated concentrations except within the Stanislaus watershed. When evaluated against USEPA's guidelines for beaches, approximately 70% of samples were acceptable for designated beaches (<235 MPN/100 ml), while 5% were acceptable for, each, moderate full body contact (<298 MPN/100ml) and light full body contact (<409 MPN/100ml), 6% were acceptable for infrequent full body contact (<575 MPN/100ml), and 16% of samples were elevated above all acceptable contact guidelines (>575 MPN/100ml). The same ratios applied year round as well as during typical high use periods.

## 10.0 FUTURE ACTIVITIES

After Water Year 2005, the SJR SWAMP effort was not able to continue the Intensive Rotational Basin effort due to funding reductions. Since 2005, the SJR SWAMP sampling has been limited to maintaining the water quality monitoring for the multi-agency Grassland Bypass Project (GBP), with addition of *E. coli* analyses twice a month at the GBP sites.

However, since 2003, expanded monitoring of agricultural drainage inflows to the SJR have been conducted by various Agricultural Coalition Groups as part of the Irrigated Lands Regulatory Program (ILRP). These monitoring activities are focused on areas below the major regulating reservoirs, including the Farmington and Valley Floor Drainage areas. Summary reports for the ILRP are available at: [http://www.waterboards.ca.gov/centralvalley/water\\_issues/irrigated\\_land/monitoring/index.shtml](http://www.waterboards.ca.gov/centralvalley/water_issues/irrigated_land/monitoring/index.shtml). The currently active groups in the Eastside Basin are the East San Joaquin Water Quality Coalition and San Joaquin County and Delta Water Quality Coalition. Additionally the Oakdale, South San Joaquin, Modesto, Turlock and Merced Irrigation Districts conduct monitoring in this Basin. Monitoring conducted by these groups includes a core of monthly monitoring at selected sites, with additional sites and constituents every three years and special management plans to address identified water quality concerns. SWAMP is providing resources to insure ILRP water quality information is captured in the statewide SWAMP master database.

In addition, multiple stakeholder groups have formed in the Tuolumne Watershed to promote education, restoration, and address concerns by both agencies and individuals. Friends of the River originated in 1973 during the conflict over the New Melones Dam. Since then, the group has grown and now takes interest in preserving, protecting, and restoring all of California's Rivers. In the upper Tuolumne Watershed, the Clavey River Ecosystem Project is dedicated to protecting the Clavey Watershed through stewardship. Also in the upper Tuolumne Watershed, the Restore Hetch Hetchy in Yosemite National Park group is working to return the Hetch Hetchy Valley in Yosemite National Park to its natural state while protecting the right of the City of San Francisco to continue to meet all of its water needs with water from the Tuolumne River. In the lower Tuolumne Watershed, the Tuolumne River Technical Advisory Committee provides a means of coordinating activities to improve conditions on the lower Tuolumne River. Throughout the entire Tuolumne River watershed, the Tuolumne River Trust strives to conserve the Tuolumne corridor and build support through chapters in the Bay area, Central Valley, and Sierra Nevada.

Also, active in the Merced Watershed is the Upper Merced River Watershed Council (UMRWC). The mission of the UMRWC is to work with individuals and organizations to protect and enhance the natural, economic, and cultural resources of the Watershed through education, community-based projects, responsible planning, and stewardship.

Based on information collected during this project and increased monitoring activities by other agencies/groups, future monitoring efforts in this basin should consider:

- Increased coordination
  - Coordinated monitoring with the Irrigated Lands Program and stakeholder groups.
  - Tie monitoring in with priorities of other efforts to include the California Watershed Council and the San Joaquin River Restoration Program
  - Mapping all NPDES, irrigated lands, and other monitoring efforts.
- Expanded studies
  - Temperature surveys in the lower watershed areas during spawning and migration periods.
  - Expanded surveys for TOC, DO, SC, arsenic, and cadmium, especially in the Farmington and Valley Floor Drainage Areas, to include examining the impact of high concentration of these constituents in these waterways plays on the San Joaquin River and Delta.

- Further evaluation of turbidity to develop natural background criteria through continuous recording of turbidity at selected reference sites to identify potential exceedances.
- Bacteria
  - Further evaluation of *E. coli* concentrations during the recreational season at areas known to be utilized for full contact recreation (e.g. local swimming holes).
  - Additional bacteria studies to determine potential sources of elevated concentrations
  - Identifying *E. coli* sources thru genetic markers

The Central Valley Regional Board SWAMP effort has refocused limited resources on better identifying current monitoring efforts conducted by both internal programs (GBP, ILRP, NPDES receiving water requirements, TMDL, and others) and major external efforts (Department of Water Resources, US Bureau of Reclamation, US Geological Survey, University of California and watershed groups) through the development of a web based surface water monitoring directory. The directory builds off of a pilot project with the San Francisco Estuary Institute (SFEI) begun by the USEPA within the San Joaquin River Basin, and has been expanded by the Central Valley Regional Board SWAMP to include the entire Central Valley (Sacramento, San Joaquin, and Tulare Basins and Delta). The web based monitoring directory is designed to only display active monitoring efforts and to identify what is being monitored where, how frequently, for how long, and by whom. While actual data is not captured, the directory will provide links to any web based data base and contact information for the monitoring program manager.

([www.centralvalleymonitoring.org](http://www.centralvalleymonitoring.org))

Related to the Eastside Basin, the Central Valley SWAMP is also currently developing a region-wide, long-term trend monitoring framework based on the 30-sites within the Central Valley that are part of the state-wide SWAMP contaminant trend monitoring effort. Selected sites in the Eastside Basin are included in the trend effort (Merced River at River Road, Dry Creek at La Loma Road, and Harding Drain at Carpenter Road).

Efforts related specifically to the elevated *E. coli* concentrations found within the SJR Basin as well as in other areas of the Central Valley as part of the ILRP monitoring follow:

- A Safe to Swim survey of *E. coli* concentrations in local swimming holes before, during, and after a holiday weekend, which was coordinated with Central Valley watershed groups during 2007 and 2008, with a follow up to the 2008 study in 2009.
- A pilot bacteria source identification project with the University of California, Davis, in selected streams that had demonstrated elevated *E. coli* concentrations.
- Continued, seasonal *E. coli* monitoring at 30 major integrator sites throughout the Central Valley in conjunction with DWR.

Documents for these studies can be found at

[http://www.waterboards.ca.gov/centralvalley/water\\_issues/water\\_quality\\_studies/surface\\_water\\_ambient\\_monitoring/swamp\\_regionwide\\_activities/index.shtml](http://www.waterboards.ca.gov/centralvalley/water_issues/water_quality_studies/surface_water_ambient_monitoring/swamp_regionwide_activities/index.shtml).

All information collected during this project has been available to the public on the Central Valley Regional Board web site within a year of collection and was also utilized along with other available data during the development of the 2006 Integrated Report – an assessment of overall surface water quality in the Central Valley and identification of impaired waterways.

([http://www.waterboards.ca.gov/centralvalley/water\\_issues/tmdl/impaired\\_waters\\_list/index.shtml](http://www.waterboards.ca.gov/centralvalley/water_issues/tmdl/impaired_waters_list/index.shtml)).

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